

REMARKS

Claims 1 and 8-11 are now pending in the application. Applicants have amended claim 1 so as to incorporate the features of previously dependent claim 7. Claims 6 and 7 are now canceled. Favorable reconsideration of the application is respectfully requested in view of the amendments to the claims and following comments.

I. CLAIM REJECTIONS UNDER 35 U.S.C. §103(a)

Claims 1, 6 and 9-11 remain rejected under 35 USC §103(a) as being unpatentable over Fuji et al. (WO 02/097107) in view of Suzaki et al. (1983), Kim et al. (2002) and Nilsson (US 6,077,695).

Applicants have amended claim 1 to include the features of previously dependent claim 7. Consequently, applicants submit that the aforementioned rejection of claims 1, 6 and 9-11 is now moot. Applicants respectfully request withdrawal of the rejection.

Claims 1 and 6-11, on the other hand, remain rejected under 35 USC §103(a) as being unpatentable over Fuji et al. (WO 02/097107) in view of Sasaki et al.¹ (1983), Kim et al. (2002), Wada et al. (JP 2003093090; machine translation) and Taguchi et al. (1994, abstract only).

The Examiner asserts that with regard to invention defined by claims 1 and 6-11, the invention would have been obvious to those skilled in the art in view of the disclosure of Fuji et al, Sasaki et al, Kim et al, Nilsson, Wada et al and Taguchi et al. In view of the amendments to the claims, however, applicants respectfully submit that the claimed invention is neither taught nor suggested by the prior art of Fuji et al, Sasaki et al, Kim et al, Nilsson, Wada et al and Taguchi et al. Those of ordinary skill in the art could not have expected to attain the significant effects thereof achieved by the present

¹ Applicants note that the reference name is actually Sasaki et al., rather than Suzaki et al.

invention by merely combining the aforementioned prior art documents, as detailed below:

Sasaki et al describes a method for obtaining an α -1,4-glucan from cellulose in three steps, wherein, phosphate concentration is set to a high concentration (i.e., equimolar phosphate concentration respect to 5mM substrate cellobiose) for the purpose of obtaining high efficiency in the second reaction. However, if this reaction is used for the 3rd reaction without removing phosphate, the concentration of phosphate is very high due to its release from G1P in the reaction. Thus, to obtain an α -1,4-glucan in a rational yield, phosphate has to be removed prior to the 3rd reaction. Therefore, the Applicants submit that those skilled in the art would not consider that these 3 steps are conducted in one reaction.

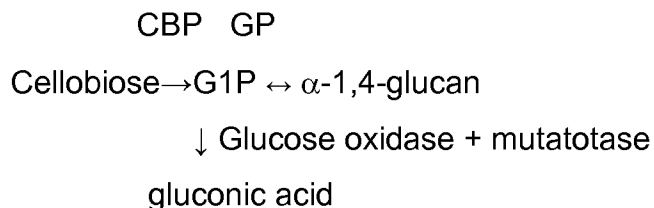
Furthermore, as shown in Table 1, page 65 of Sasaki et al, the conversion ratio (%) of Cellobiose \rightarrow Glucose 1-P is 20.2, and the conversion ratio (%) of Glucose 1-P \rightarrow α -1,4-glucan is 55.4. Thus, if these reactions are conducted in one reaction system, the conversion ratio (%) of the reaction producing α -1,4-glucan from cellobiose is expected to be $20.2(\%) \times 55.4(\%) = \text{about } 11.2(\%)$.

However, in contrast the present invention results in about 3 times the conversion ratio being achieved by conducting these reactions in one reaction system, as supported by example 5-1 of the present specification wherein the yield (= conversion ratio) is 32.8%. Furthermore, by removing glucose which is produced as a byproduct from the reaction solution simultaneously with production of the α -glucan using glucose oxidase and mutarotase as now recited in claim 1, the conversion ratio is increased to at least 54.9% as shown in examples 5-3 and 5-4 of the present specification. This conversion ratio is at least about 5 times of the conversion ratio expected from the Sasaki et al, and pertains to an unexpected effect.

Furthermore, the effect obtained by removing glucose is only about 2% (45.1% \rightarrow 47.2%) when using glucose isomerase and about 5% (45.1% \rightarrow about 50%) when using glucose oxidase in Wada. This improving effect is quite small compared with the improving effect obtained by the present invention.

Therefore, the effect obtained by the present invention as recited in amended claim 1 is unexpected from the combination of Sasaki et al and other cited references.

The present invention according to the amended claims can be summarized as follows:



The reaction step which produce a desired product in Nilsson et al corresponds to the 1st reaction (Cellobiose \rightarrow G1P which is catalyzed by CBP) in the present invention. Nilsson et al implies that the byproduct glucose which is simultaneously produced with the desired product, inhibits a cellobiose decomposition, and as a result, the yields of the desired product are reduced.

The desired product (inulin) of Wada et al is also simultaneously produced with the byproduct glucose.

$\alpha\text{-1,4-glucan}$ which is a desired product of the present invention is not produced by the 1st reaction but produced in the 2nd reaction. In this 2nd reaction (G1P \leftrightarrow $\alpha\text{-1,4-glucan}$ which is catalyzed by GP), inhibition of GP by glucose would not be predicted from the cited references. Specifically, the extent of the effect would not be predicted with respect to the $\alpha\text{-1,4-glucan}$ yield obtained by removing glucose from the combination of Wada, Nilsson, Fujii, and Sasaki. This is because by coexisting glucose oxidase in the reaction system of the present invention, the reaction cellobiose \leftrightarrow G1P substantially became non-equilibrium reaction, i.e., the reaction only proceeds to the direction cellobiose \rightarrow G1P. This is because the reaction G1P \rightarrow gluconic acid is a non-equilibrium reaction. Thus, in the reaction system of the present invention, only the reaction G1P \leftrightarrow $\alpha\text{-1,4-glucan}$ is an equilibrium reaction. Thus, the reaction system of the present invention is different from the reaction system of Fujii et al which uses two equilibrium reactions.

Furthermore, the Examiner describes on Page 8 of the Final Office Action that "the ordinary artisan would reasonably have expected an increased yield in coupled CBP/SP system as claimed since the by-product, glucose, is being removed". However, the present invention does not use SP. SP is a completely different enzyme from GP which is used in this invention. Thus, those skilled in the art would not expect from the disclosure of Fujii et al that removal of glucose would increase the yield of α -1,4-glucan.

Additionally, applicants note the problem solved by the present invention, which is the development of a low cost, simple and effective method for performing a reaction in a single reaction system by coupling of enzymes, in order to produce a significant yield of α -glucan from cellobiose. Neither (i) the problem to be solved, (ii) the mechanism to arrive at the solution, nor (iii) the effects obtained therefrom are common between the present invention and the prior art, and are neither taught nor suggested therein. Applicants respectfully submit that as a consequence the Examiner has based the outstanding rejection upon *ex post facto* analysis and mere inference and supposition that those skilled in the art would have expected to have succeeded in achieving the claimed method and expected the significant α -glucan yields therefrom.

Therefore, in view of the aforementioned, applicants respectfully submit that the the problem to be solved by the claimed method nor the disclosure of Fuji et al, Sasaki et al, Kim et al, Wada et al and Taguchi et al as a whole establish even a *prima facie* case of obviousness.

II. CONCLUSION

Accordingly, claims 1 and 8-11 are believed to be allowable and the application is believed to be in condition for allowance. A prompt action to such end is earnestly solicited.

Should the Examiner feel that a telephone interview would be helpful to facilitate favorable prosecution of the above-identified application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Application No: 10/596,243

Should a petition for an extension of time be necessary for the timely reply to the outstanding Office Action (or if such a petition has been made and an additional extension is necessary), petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988.

Respectfully submitted,

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